

1. A sound-absorbing shield device for use in a vehicle door, comprising:

a sheet of sound-absorbing material;

a thin sheet of polymer film having a first face

5 attached to a first face of the sound absorbing material;
a plurality of apertures extending through the polymer film from the first face thereof to a second face thereof opposite the first face;

10 each aperture bounded by a hollow protrusion extending from said second film face, the apertures and protrusions cooperating to form a barrier against environmental contamination while admitting acoustic energy therethrough.

15 2. The shield device of claim 1, wherein the sound-absorbing material is a foam material.

3. The shield device of claim 1, wherein the sound-absorbing material is an open-cell foam material.

4. The shield device of claim 1, wherein the sound absorbing material is a polyurethane foam material.

20 5. The shield device of claim 1, wherein the polymer film is a polyethylene film.

25 6. The shield device of claim 1, further comprising an imperforate polymer film attached to a second side of said sound-absorbing sheet opposite the first side thereof.

7. The shield device of claim 6, further comprising a polymer film sealing a peripheral edge of said sound-absorbing sheet, said peripheral edge transverse to the first and second faces of the sound-absorbing sheet.

8. The shield device of claim 1, further comprising an adhesive attached to a second side of said sound-absorbing sheet opposite said first side.

5 9. The shield device of claim 8, further comprising a protective sheet removably engaging said adhesive.

10 10. The shield device of claim 1, wherein said sheet of sound-absorbing material has a variable thickness.

11. The shield device of claim 1, wherein said sheet of sound absorbing material comprises a sheet of foam having a region of reduced foam thickness.

12. The shield device of claim 11, wherein said region of reduced foam thickness is located at a peripheral edge of the shield device.

15 13. The shield device of claim 11, wherein the region of reduced foam thickness overlies an opening formed in the polymer film.

20 14. The shield device of claim 11, wherein the region of reduced foam thickness overlies a laterally deflectable pocket formed in the polymer film.

15. The shield device of claim 11, wherein the region of reduced foam thickness is formed by cutting.

25 16. The shield device of claim 15, wherein the region of reduced foam thickness is sufficiently thin to allow the passage of light.

17. A method of forming a shield device for use in an automobile door, comprising:

providing a sheet of polymer film material;

forming a plurality of perforations extending through said sheet of polymer film from a first face of said film to a second face thereof opposite said first face;

5 forming, at the same time said perforations are being formed, hollow protrusions, each bounding a perforation and extending away from the second face of said polymer film, the apertures and perforations cooperating to form a barrier against environmental contamination while increasing acoustic transparency of the film; and,

10 attaching the first side of the polymer film to a first side of a sheet of sound absorbing material.

18. The method of claim 17, wherein the perforations are formed using a vacuum perforation technique.

19. The method of claim 17, wherein the sound-absorbing material is a foam material.

20. The method of claim 17, wherein the sound-absorbing material is selected from an open-cell foam material and a polyurethane foam material.

21. The method of claim 17, wherein the polymer film is a polyethylene film.

22. The method of claim 17, further comprising attaching an imperforate polymer film layer to a second side of said sound-absorbing sheet opposite the first side thereof.

23. The method of claim 22, further comprising attaching a polymer film to a peripheral edge of said sound-absorbing sheet, said peripheral edge transverse to the first and second faces of the sound-absorbing sheet.

24. The method of claim 17, further comprising an adhesive attached to a second side of said sound-absorbing sheet opposite said first side.

25. The method of claim 24, further comprising a protective sheet removably engaging said adhesive.

26. The method of claim 17, further comprising forming a region of reduced foam thickness in said sheet of
5 sound absorbing material.

27. The method of claim 26, wherein said region of reduced foam thickness is located at a peripheral edge of the shield device.

10 28. The method of claim 26, wherein the region of reduced foam thickness overlies an opening formed in the polymer film.

29. The method of claim 26, further comprising forming a laterally deflectable pocket in the region of reduced foam thickness.

15 30. The method of claim 26, wherein said region of reduced foam thickness is formed by cutting .

31. The method of claim 30, wherein the region of reduced foam thickness is sufficiently thin to allow the passage of light.

20 32. A method for sealing a vehicle door against sound and environmental contamination entering an interior compartment thereof, said vehicle door being of a type comprising an outer door panel and an inner door panel having an opening therein, the method comprising:

25 providing a sealing system having a size and shape to generally conform to the opening in the inner door panel, said sealing system comprising:

30 a sheet of sound-absorbing material;
a thin sheet of polymer film having a first face attached to a first face of the sound absorbing material;

a plurality of apertures extending through the polymer film from the first face thereof to a second face thereof opposite the first face; and

5 each aperture bounded by a hollow protrusion extending from said second film face, the apertures and protrusions cooperating to form a barrier against environmental contamination while admitting acoustic energy therethrough; and,
10 installing said a sealing system onto the vehicle door.

33. In a vehicle door construction having an outer door panel and an inner door panel with a trim panel joined to the inner door panel, and a shield device positioned between the trim panel and the inner door panel, the improvement wherein the shield device comprises:

15 a sheet of sound-absorbing material;
a thin sheet of polymer film having an inboard 20 facing surface attached to an outboard facing surface of the sound absorbing material;
a plurality of openings extending through the polymer film from the inboard facing surface thereof to an opposite, outboard facing surface of the film;
25 each opening bounded by a hollow protrusion extending from said outboard facing film surface, the openings and protrusions cooperating to form a barrier against environmental contamination while admitting acoustic energy therethrough.

30 34. In the vehicle door construction as defined in claim 33, the improvement further wherein said protrusions extend outwardly from said outboard facing film surface at an angle which is less than or equal to horizontal when said shield device is installed in a vertical operating position.

35. In a vehicle door construction having an outer door panel and an inner door panel with a trim panel joined to the inner door panel, and a shield device positioned between the trim panel and the inner door panel, the improvement wherein the shield device comprises:

a sheet of sound-absorbing material having an outboard facing surface in acoustic communication with an outboard side of said vehicle door; and,

an imperforate polymer film attached to an inboard 10 facing surface of the sound absorbing material opposite the outboard facing surface.

36. In the vehicle door construction as defined in claim 35, the improvement further wherein said sheet of sound-absorbing material comprises a hydrophobic foam material.